Some verbal inaccuracies which had crept into the first translation have been corrected, and in every respect the editor may be congratulated on the work in its present form. It will be of the greatest use to students—especially, perhaps, to those who have to work alone.

D. H. S.

Traité d'Optique. Par M. E. Mascart. Tome I. (Paris: Gauthier-Villars, 1889.)

THIS is the first half of a very elaborate treatise on optics, the full scope of which we cannot tell till the second volume appears, as no hint is given of what is yet to come. This first volume begins with the fundamental principles of the wave-theory of light, deduces from them the elementary laws of geometrical optics, discusses the properties of a co-axal system of refracting surfaces, describes the structure of the eye, expounds the facts of colour-mixture, points out the conditions which determine the resolving power of a telescope, develops at great length the theories of diffraction and interference, with some of their principal applications, and devotes about 80 pages to polarization and double refraction. There is practically nothing about the microscope, and nothing at all about the paths of rays in media of continuously varying density.

The book is by no means easy reading, and the labour of perusing it is increased by the smallness of the reference letters (with their numerous accents and suffixes) which occur in the figures. The plan involves much specialization. For instance, the proof of the formula for retardation on which the theory of Newton's rings depends is not given in the sections devoted to Newton's rings and colours of thin plates, but some 370 pages earlier. In many cases, when the student has found a formula which appears to contain the information of which he is in quest, he has to search carefully through a long series of preceding pages before he can find the meaning of some symbol which occurs in it. The volume contains a vast store of information, but not generally in a form to suit hasty seekers after truth. It requires to be studied at leisure, and the time so spent will not be wasted. Great pains have obviously been taken to embody the latest information and present it in the clearest form. We may instance the spiral curves which illustrate the values of Fresnel's integrals, and the curve (to which a folding-plate is devoted) showing the relations of the colours of diffraction fringes to the three primary colours. There is an excellent discussion of the theory of concave gratings, both for reflection and refraction. The least attractive chapter is that entitled "Properties of Vibrations." It is a discussion of the composition of simple harmonic motions, and occupies 40 pages bristling with elaborate formulæ. We think a more moderate display of mathematics under this head would have sufficed.

The order of arrangement adopted in the volume is rather peculiar, and baffles all *a priori* conjecture. For instance, the discussion on colour-mixtures occurs in a chapter on "Interferences," and the investigation of the conditions which determine the resolving power of a telescope is given in the introductory chapter under the head of "Preliminaries."

The book is essentially a mathematical treatise, all experimental descriptions being reduced to the narrowest possible limits.

The preface states that the work is addressed mainly to "pupils of the Faculties and Schools of higher instruction," but we think its principal use in this country will be as a book of reference for teachers. Its value for this purpose will be greatly increased if a good alphabetical index is added at the end of the second volume.

J. D. EVERETT.

Bibliothèque photographique: Le Cylindrographe, Appareil panoramique. Par P. Moëssard, Commandant du Génie breveté, attaché au Service géographique de l'Armée. (Paris: Gauthier-Villars, 1889.)

THIS is a description of a photographic camera invented by Colonel Moëssard, in which the lens is pivoted on an axis, and the sensitive film is arranged in a cylindrical form about this axis, on a radius equal to the focal length of the lens. By this means a panoramic view of angular breadth up to 170° can be taken. The camera being fixed in position, the lens is uncapped, and then rotated quickly or slowly, according to the speed of the plate, and the intensity of light in any direction. The author claims for the instrument useful employment in surveying, either in the carefully detailed plans of an ordnance survey, or in the rapid views useful for warlike purposes, which the instrument can afford. Two photographs taken with the aid of the instrument illustrate very favourably its powers, especially for architectural purposes.

A Hand-book of Modern Explosives. By M. Eissler. (London: Crosby Lockwood and Son, 1889.)

IN this book the author of "Modern High Explosives" has collected much useful information about the various explosives now in use. The greater part of the work is devoted to nitro-compounds, but short accounts of the other types of explosives now being manufactured are added. The manufactures of gun-cotton and nitroglycerine receive full treatment, together with the modifications introduced in the various large factories both of America and Europe. The important subject of the use of explosives in fiery mines has a chapter to itself. The description of the tests of flameless powders is of especial interest; in fact, the official reports of the tests of many of the most important explosives are perhaps the most instructive portions of the book. The chapter dealing with the practical application of explosives should be useful not only to the miner, but also to officers of both services to whom blasting and the use of explosives generally may at any time become a necessary auxiliary. An interesting account of the history and trials of the Lalinsky gun, together with the manufacture and use of gun-cotton shells, is also well worthy of their perusal. Little is said on the use of explosives below water, especially on the subject of the removal of wrecks, which would stand far fuller treatment. Four appendices are added, two dealing with the analysis and determination of stability of explosives, and one containing abstracts from the principal provisions of the Explosive Act of 1875. Although there is much that is necessarily old, still this is a book that will be read with interest by most who are accustomed to work with high explosives. The illustrations are well executed, and the whole wonderfully free from printer's errors.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Peltier Effect, and Contact E.M.F.

WITHOUT any further reference to the heading of a letter on p. 102, signed "The Reviewer," I wish to discuss an interesting argument therein propounded as proving that a true electromotive force at contact between two metals cannot be the cause or sole cause of the Peltier effect, unless the latter be simply proportional to absolute temperature. The argument is very like one that I indistinctly remember to have heard suggested some time ago by Prof. Schuster, and it struck me at the time as ingenious and not easily answerable.

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On seeing it in print, however, a natural answer occurs to me, which it may be worth while to give. The whole point of the reasoning depends on assumed properties of vacuum.

The assumptions are as follow :—

(1) That a perfect vacuum is an absolute non-conductor of electricity.

(2) That no contact E M.F. exists between a metal and a vacuum.

(3) That vacuum has a specific inductive capacity.

Grant all these, and the argument is sound. Decline to admit any of them, and it proves nothing. Break down the first two of them, and it proves too much: it proves the non-existence of any thermal contact-force whatever between conductors. For if there were any E.M.F. at the metallic contact, and none at the other or vacuum contacts, a continuous current would flow, propelled by energy derived from a cold place.

This argument is indeed the ordinary one to prove that the algebraic sum of the E.M.F.'s at all the junctions of a closed conducting circuit in which no energy but heat is supplied must be zero when the temperature is uniform.

The proof scarcely holds when insulators are interposed, though the *fact* may be true nevertheless. When chemically active substances with their extraneous supply of energy are interposed, the fact itself is no longer true. But how do we know what is true when vacuum is interposed? The hypothesis on which the argument is founded is a baseless conjecture.

But it may be said, Are not the hypotheses probable? Do you not yourself believe them? I believe in (1) and (3) provisionally, but certainly not in (2). The contact E.M.F. between two substances is probably some surface action or skin phenomenon, and I see no reason why it should not occur as well in the boundary between metal and void as in the boundary between one metal and another. Indeed, it is not improbable that the sum of the E.M.F.'s in *every* circuit of chemically inert substances, whether conducting or not, and inclusive of vacuum, is zero under uniform temperature conditions.

All that is wanted to establish this is the knowledge that in a circuit of any one substance at non-uniform temperature the total E.M.F. shall be zero,[1] or that the Thomson effects in a single substance always balance each other; *i.e.* that the total E.M.F. in a circuit shall depend on a potential function of temperature, or $dE = f'(t)dt$.

Now it is quite true that this $f'(t)$ is the Peltier coefficient divided by absolute temperature, and that $f(t)$ in its most general form contains an arbitrary constant, but what of that? Nothing is known of $f(t)$ except that it is a potential function: it is not known to represent any physical effect. I never said that the Peltier effect enabled us to find the most general form of the function $f(t)$; I said it gave us the E.M.F. at a junction.

And there is much ground for the assertion; for it is easy to show that in a simple AB circuit, with junctions at t_1 and t_2, the total E.M.F. is

$$E = \Pi_1 - \Pi_2 + \int_{t_2}^{t_1} (\Theta_A - \Theta_B)dt ;$$

just as if the resultant E.M.F. were the algebraic sum of two Peltier E.M.F.'s and of two Thomson E.M.F.'s.

My only contention is that this equation, which is undeniably true when the Π are interpreted as heat-coefficients, is also true and immediately interpretable when they stand for contact E.M.F.'s. The burden of proof as to the physical existence of an unnecessary and in every sense arbitrary constant rests with those who doubt this simple explanation.

It is difficult to see how a doubt can arise, or how the Peltier and Thomson productions or destructions of heat can be accounted for without local E.M.F.'s. Nohow, so Dr. Hopkinson has proved, and I also have insisted (*Phil. Mag.*, October 1885, and March 1886), except by some wildly gratuitous assumption of an actual physical specific heat for electricity, dependent on the temperature and on the metal in which it happens to be.

Liverpool, December 14, 1889. OLIVER J. LODGE.

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[1] Hopkinson virtually pointed this out, *Phil. Mag.*, October 1885.

Mirages.

THE article in NATURE of November 21, 1889 (p. 69), recalls to me mirages I saw in March 1888, while travelling in the East on the steam yacht *Ceylon*.

On the 29th we were crossing the Black Sea from Sebastopol. It was a fine cool day and quite calm. In the afternoon a false or mirage horizon about 3° above the true one was visible for a few hours. No objects were within range of vision. The mirage disappeared as the sun declined.

The next day was very much warmer, and we saw a more marked and interesting mirage in the afternoon as we were steaming across the Sea of Marmora away from Constantinople. In this case it appeared only in the west, and objects were seen reflected in an inverted position. A small conical-shaped island was seen with its inverted image at times distinct from and at times blending with the original. The image was distinctly seen of some land, which was actually below the horizon. The mirage of the reflection of the sun in the sea was, when seen through a glass, especially beautiful. It resembled a glorious cataract of golden water. This mirage lasted till quite the dusk of the evening, and then gradually thinned down and died away.

I do not know whether mirages at sea are uncommon; but as the officers on board did not remember seeing one before, I thought these instances might be worth recording.

ARTHUR E. BROWN.

Thought Cot, Brentwood, December 31, 1889.

Self-luminous Clouds.

I AM very sorry that I took no notes, some six or seven years ago, on the first and only occasion of my seeing self-luminous clouds, but though I can give neither date nor positions, the following facts are still fresh in my memory.

Passing through Bushey Park after dark, I noticed an aurora borealis, and, as I had only recently seen the rather rare phenomena of the rays of the setting sun converging towards a point in the east, I followed the direction of one of the principal beams of light towards the south, when, at a point somewhat south of my zenith, I noticed an equatorial belt of luminous clouds. I found that each cloud belonged to a ray, and faded and brightened with it, but was separated by about 60° of clear sky. This belt of clouds extended down to the western horizon, the eastern one was obstructed by trees, while shortly afterwards small dark clouds appeared on that side, and the sky soon became overcast.

The luminous clouds were quite transparent, so that even faint stars could be seen through them when at their brightest. I have heard from Scandinavian captains that these luminous belts are sometimes seen in northern latitudes, and are sure signs of bad weather. I have written these few remarks in the hope that those of your readers who may have the chance of seeing an aurora borealis will also look out for these clouds, and if possible determine their position. C. E. STROMEYER.

Strawberry Hill, January 4.

The Revised Terminology in Cryptogamic Botany.

THE anglicized forms of most of the terms in common use, employed in the "Hand-book of Cryptogamic Botany" recently issued by Mr. G. Murray and myself, have not up to the present time found much support from our fellow-botanists. I propose, therefore, to give, in some detail, the reasons which have induced us to adopt them, and to urge their general use on writers on cryptogamic botany. For this purpose we will take as our text extracts from three reviews of the "Hand-book," marked, as all the critiques have been, with only one or two exceptions, by a generous appreciation of the difficulties of our task, and a too great leniency to the many shortcomings of the work :—"The most conspicuous, though not the most important, of these [changes] is the adoption of anglicized terminations for Latin and Greek technical words. This is a matter in which it is hard to draw the line aright. . . . As a matter of taste we think the authors have gone much too far in this direction. They complain of the 'awkwardness and uncouth form of these words'; we should have thought the reproach applied much more strongly to 'cœnobe,' 'sclerote,' 'nemathece,' and 'columel'" (NATURE). "An Englishman may guess what 'archegone' is short for, for example; but why puzzle a foreigner with a new form of a word with which he is familiar in every treatise hitherto written on the special subject in any European language?" (*Academy*). "Too sanguine expectations on this head might well be toned down by remembering the complete failure of the somewhat similar experiment made by Lindley. . . . Primworts, spurgeworts, bean-capers, and hip-

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